CASE REPORT

Primary Distal renal tubular acidosis: case series

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ABSTRACT

Primary Distal renal tubular acidosis is an infrequent tubular disorder with complex pathophysiology that present with poor growth, skeletal changes and sometimes life-threatening hypokalemia. Here we present two siblings one girl and one boy with a consanguineous parents presented with polyuria, polydipsia, failure to thrive and skeletal deformity. Both cases showed non-anion gap metabolic acidosis with alkaline urine and the younger brother had periodic paralysis due to hypokalemia. After diagnosis and treatment they showed good response with alkali therapy.

Key words: Renal tubular acidosis, autosomal recessive, failure to thrive, alkali therapy.

Introduction

Kidney contribute to acid-base balance by reabsorption of filtered bicarbonate (HCO3-) and excretion of hydrogen ion (H+). All filtered HCO3- should absorbed before dietary H+ can be excreted. About 90% HCO3- absorbed in the proximal tubule and 10% in the distal tubule. 1 Renal tubular acidosis is a condition that causes accumulation of acid in the body due to failure of the kidneys to appropriately acidify the urine and characterized by normal anion gap metabolic acidosis and normal or near-normal glomerular filtration rate. [1,2]

RTA occur due to impairment of bicarbonate reabsorption or excretion of H+ ions or a combination of both. In children distal RTA (type 1) and proximal RTA (type II) are common and third form (type IV) characterized by hypoaldosteronism and hyperkalemia which is very rare.[1,3] This tubular defect may be hereditary/primary originating from genetic defect or acqutrait whereas pRTA occurs as AR ired (secondary) due to systemic disease or adverse drug reactions.[4,5,6] Inherited form of dRTA may be autosomal dominant and autosomal recessive with or without deafness. Dominant disease usually presents in late childhood but recessive variant presents in infancy /early childhood.[1,4,7]

In dRTA there is failure of H+ secretion into the lumen by alpha intercalated cells of the collecting duct and distal nephron leads to inability to acidify urine and consequently develop academia. Loss of sodium bicarbonate distally, due to lack of H+ to bind to in the tubular lumen results increase chloride reabsorption and hyperchloremia. As H+ not excreted K+ cannot reclaimed by cells and produce hypokalemia. In acidosis urinary citrate excretion increase. Both hypocitraturia and alkaline urine aggravates deposition of calcium phosphate and form nephrocalcinosis.[1,2,3]

Distal RTA shares features with pRTA including non-anion gap metabolic acidosis and growth failure. During infancy and early childhood the clinical features include failure to thrive, polyuria, polydipsia, muscle weakness due to hypokalemia and sometimes severe rachitic deformities.[1,3] Growth failure is due to chronic acidosis itself and bony changes due to acidosis induced loss of bone minerals.[1]

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The diagnosis can be made by presence of alkaline urine with normal anion gap systemic academia. In case of incomplete dRTA ammonium chloride loading test shows failure to acidify urine. The treatment is straightforward that the correction of academia with oral sodium bicarbonate, sodium citrate, or potassium citrate.[1,3]

Case 1

The index case a 13-year-old girl was born to healthy consanguineous parents was first hospitalized at the age of 4 years of her age with the complaints of bowing of legs and failure to thrive since her early infancy. She had history of polyuria and polydipsia for 9 months. Initially she was treated as nutritional rickets with vitamin D (stoss therapy) supplementation for 3 times without any significant improvement. There was no history of any fever, head trauma, urinary urgency, hematuria, or taking any offending drugs. Physical examination revealed she was fatigue but alert, afebrile, mildly pale, tachypnoeic, tachycardic, normotensive, severely stunted and moderately wasted. She had mild motor delay with reduced tone and power in lower limbs and normal tendon reflexes. No abnormalities of the heart, lungs or abdomen was found. The laboratory findings are shown in Table 1. These values were consistent with non-anion gap hyperchloremic metabolic acidosis with hypokalemia and hypocalcemia. Urinalysis showed alkaline PH with positive urinary anion gap. X-ray lower limb showed features of rickets. X-ray and ultrasonography of KUB showed normal findings. The patient was treated with oral shohl's solution three times a day along with sodibicarb 1 tab three times daily and oral potassium supplements two times daily. Calcium and vitamin D supplementation were also given. Up to now, she has been followed for last 9 years and dosage were adjusted and her rachitic changes resolved, achieved all age appropriate gross motor milestone and has had normal puberty. She has had quite good academic performance.

Case 2

A 7.5-year-old male the younger brother of 1st case and 2nd issue of her parents presented with paralysis of both lower limb following a history of vomiting for several times. He also had polyuria, polydipsia failure to thrive since his 2 years of age. He had same type of illness like generalized weakness, transient lower limp paralysis about 4-5 times for last 2 years. But parents did not seck any medical help as he had no apparent bony deformity. As the child condition was gradually worsening the hospitalized him. Like his sister he had no history of any fever, head trauma, convulsion, dribbling of urine, hematuria, or taking any offending drugs. On physical examination he was lethargic, afebrile, some signs of dehydration, tachypnoic, tachycardic, normotensive, severely stunted and wasted. Neurological examination revealed muscle power 4/5 in upper limb and 2/5 in lower limb with no signs of meningeal irritation. Other systemic examination revealed no abnormality. The laboratory findings shown in Table 1. Blood and urine examination consistent with dRTA with severe hypokalemia and x-ray lower limb shows early features of rickets without any evidence of nephrocalcinosis. His general condition also improved after one month of treatment.

Table 1: Laboratory findings of two cases.

Investigations		1st case	2nd case
S. potasium		2.3 mmol/L	1.8 mmol/L
S. chloride		12o mmol/L	115 mmol/L
	PH	7.19	7.22
ABG	PCO2	16 mmHg	19.5 mmHg
	HCO3	9 mmol/L	9 mmol/L
S. anion gap		10	13
Urine anion gap		36	35

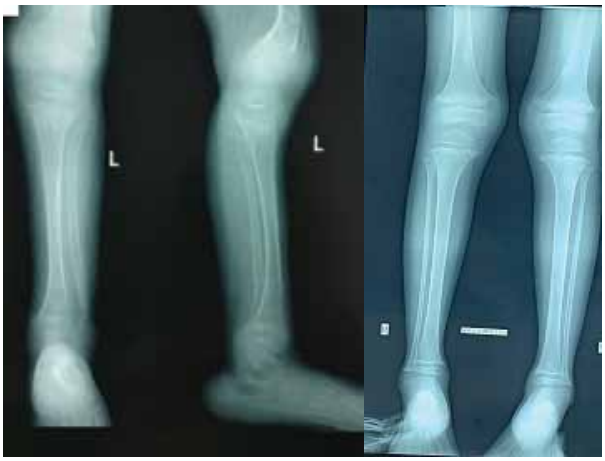

Fig 1. Bone radiographs of the patients, 1st one was elder sister showed rachitic changes in the lower extremities and 2nd one was her brother shower early changes of rickets.

Discussion:

Some characteristics of the clinical picture presented in the two patients of same family draw attention and deserve to be analyzed. The two siblings presented with different symptoms like elder sister mainly presented with rickets but younger brother presented with muscle weakness and paralysis. The other manifestations of the both siblings like polyuria, polydipsia and growth failure, which is frequently reported in dRTA.[8,9] Hypokalemic paralysis and progressive weakness are rare manifestations reported in children but common in adult.[10] However, rickets is common in untreated dRTA because of bone resorption to buffer chronic metabolic acidosis.[11]These cases also coincided with that is reported in the literature regarding clinical presentation at a very young age is almost always primary[12,13] and we did not get other possible clue for secondary dRTA although genetic studies were not carried out. The majority of patients with autosomal recessive distal RTA have sensorineural deafness but none of our patients had hearing impairment, which is compatible with dRTA type 1c.[14]

Both of our patients had typical findings of RTA, including metabolic acidosis with a normal anion gap and hypokalemia. Additional findings of alkaline urine, positive urine anion gap and rickets suggested that both of them had dRTA. These findings are consistent with other literature.

Distal RTA is often associated with nephrocalcinosis and progression of nephrocalcinosis may lead to development of CKD.[15] Fortunately none of our patients had nephrocalcinosis. Literature showed that proper diagnosis early therapy usually leads to an excellent prognosis.[16,17] Similarly both of our patients showed complete symptomatic recovery and achieved catch-up growth.

To best of our knowledge this is one of the first family cases with dRTA reports in our country. In Colombia there was a reported case series where 3 siblings presented dRTA in early infancy and identified as autosomal recessive presentation.[18]

Conclusion

Distal RTA in children is a controllable disease with favorable long-term prognosis. Early detection and accurate characterization of this condition is pivotal to uncover an underlying disease, tailor a specific therapy, and prevent further renal function decline. Treatment during the early stages in infant with dRTA is of great importance for patient prognosis.

Conflict of interest: none.

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